

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
21 February 2002 (21.02.2002)

PCT

(10) International Publication Number
WO 02/15211 A1

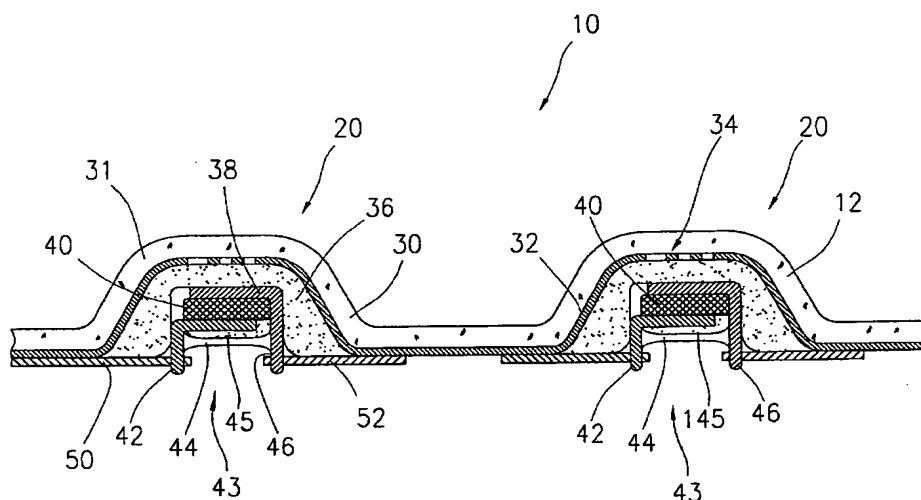
- (51) International Patent Classification⁷: **H01H 13/70**
- (21) International Application Number: PCT/IB01/01483
- (22) International Filing Date: 17 August 2001 (17.08.2001)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
09/641,199 17 August 2000 (17.08.2000) US
- (71) Applicant: **NOKIA CORPORATION** [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI).
- (71) Applicant (for LC only): **NOKIA INC.** [US/US]; 6000 Connection Drive, Irving, TX 75039 (US).
- (72) Inventors: **ÖSTERGÅRD, Toni**; Ruukinkatu 1839, FIN-20540 Turku (FI). **KAIKURANTA, Terho**; Sorvakuja 7, FIN-20760 Piispanristi (FI). **SVARFVAR, Bror**; Vaakunatie 7 a 4, FIN-20780 Kaarina (FI).
- (74) Agent: **MAGUIRE, Francis, J.**; Ware, Fressola, Van Der Sluys & Adolphson LLP, 755 Main Street, P.O. Box 224, Monroe, CT 06468 (US).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

[Continued on next page]

(54) Title: ARRANGEMENT FOR INTEGRATION OF KEY ILLUMINATION INTO KEYMAT OF PORTABLE ELECTRONIC DEVICES



(57) Abstract: An integrated keymat or keyboard to be used on an electronic device. The integrated keymat includes a plurality of individual emissive keypads each having a legend or symbol provided thereon. The emissive keypad has a light-emitting source and a plurality of electrodes, operatively connected to a power source, to activate the light-emitting source in order to illuminate the keypads, wherein the connection of the electrodes is controllable so that one or more keypads can be illuminated causing the key indicating marks on said one or more keypads to become more visible. Furthermore, the light-emitting source may include a plurality of segments of pixels which are individually addressable so that they can be selectively activated to form an alphanumeric symbol or pattern. Moreover, the integrated keymat further comprises one or more lens-like pads provided on the keypads to make the legend or symbol on the keypads more visible.

WO 02/15211 A1



— *entirely in electronic form (except for this front page) and available upon request from the International Bureau*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ARRANGEMENT FOR INTEGRATION OF KEY ILLUMINATION INTO KEYMAT OF PORTABLE ELECTRONIC DEVICES

Field of the Invention

The present invention relates generally to a keymat or keyboard to be used on a portable electronic device and, more particularly, to a keymat or keyboard that has a plurality of illuminated keypads.

Background of the Invention

In a portable electronic device, such as a mobile phone, a communicator, a personal data assistant (PDA), a portable communications device or the like, a keyboard is usually used to provide a User Interface (UI) between the user and the device. Typically, the keyboard includes a plurality of alphanumerical keypads and/or function keys to allow a user to select a function or to key a value into the device. When the ambient lighting is inadequate, it is essential that the keypads or keys are illuminated so that the user can correctly select the keys.

In a conventional illuminated keyboard including a keymat and an underlying circuit board, discrete light-emitting devices (LEDs) are surface-mounted on the circuit board to provide illumination to the keypads thereabove. Alternatively, light guides or conduits are used to guide light from one or more light sources on the circuit board to the proximity of the keypads. Conventionally, all the LEDs mounted on the circuit board, as described above, are turned on or off at the same time. Thus, like the light guides, the LEDs for illuminating the keypads cannot be selectively controlled. Furthermore, the surface-mounted LEDs are bulky and their power consumption is usually high. Because of their bulkiness and high power consumption, these surface-mounted LEDs are not optimal for use in a small portable electronic device.

On a mobile phone, a communicator and any other portable communications device, there is usually an information display panel, such as an LCD panel, for providing information to the user. Typically, one or more softkeys are used to guide the user to operate the device. A softkey has a function displayed at a designated area

of the display panel and an associated keypad located outside the display panel adjacent to the designated area. A user can use the associated keypad to choose the function of the softkey. For example, two softkeys are often used in a Nokia mobile phone to assist a user to operate the mobile phone. When the mobile phone is turned on, the initial functions of these two softkeys are shown as "Menu" and "Name" at their corresponding designated areas. By choosing the "Menu" function through the associated keypad, the displayed functions of the two softkeys will change to "Select" and "Exit". The "Select" and "Exit" functions are "requests" to the user, asking the user to choose the next course of action regarding the use of the mobile phone. In this way, the user is provided with a guide to operate the device according to the displayed functions of the softkeys at a given moment. However, this type of softkey has several disadvantages, as described below. Because the function of the softkey is shown at a designated area within the display panel, the use of softkeys significantly reduces the available area for displaying other messages on the display panel. Thus, for practical reasons, the number of softkeys is limited to only a few. Moreover, it has been found that some users are confused over the "requests" shown at the designated areas of the display panel and usually cannot relate the requests to the associated keypads. This psychological obstacle is a real problem for traditional softkeys.

It is advantageous and desirable to provide a keymat, wherein the illuminating light sources are small and have low power consumption, and wherein illumination of the keypads can be selectively controlled. Furthermore, the illuminated keypad areas can include alphabetical letters, numerals, text and/or graphical images to indicate the functions of the keypads so that these keypads can be used to replace the softkeys in certain portable electronic devices.

Disclosure of the Invention

It is an objective of the present invention to provide an integrated keymat to be used on a portable electronic device, wherein the keymat includes one or more emissive keypads having legends or other key indicating marks provided thereon, and wherein the keypads can be individually illuminated so as to allow the legends on the

keypads to become more visible. Accordingly, the keymat comprises separate light-emitting components provided on the emissive keypads and electrodes for activating the light-emitting components in order to illuminate the keypads, wherein the electrodes are operatively connected to electrical connectors which provide electrical power to the electrodes, and wherein the electrical connections to the electrodes are controllable so that the keypads can be selectively illuminated.

Preferably, the light-emitting component in a keypad comprises a single light-emitting pixel to illuminate the legend on the keypad.

Alternatively, the light-emitting component in a keypad comprises two or more light-emitting pixels which can be selectively activated to illuminate one or more segments of the legend on the keypad.

Alternatively, the light-emitting component in a keypad comprises a plurality of light-emitting pixels forming a pixel matrix, wherein the pixels of the matrix are individually addressable so as to allow one or more pixels within the keypad to be selectively activated to form a selectable illuminating pattern.

Alternatively, the light-emitting component in a keypad comprises a plurality of light-emitting segments, wherein the segments are individually addressable so as to allow one or more segments within the keypad to be selectively activated to form an illuminating pattern in a form of an alphanumeric or other symbol.

The integrated keymat of the present invention can be integrated into a circuit board having a control circuit which controls the activation of the light-emitting components, wherein the circuit board can be rigid, flexible or of any other form.

The integrated keymat of the present invention can be integrated into a circuit board having a display panel which can be used to display information related to the activated light-emitting components, wherein the circuit board can be rigid, flexible or of any other form.

Preferably, the integrated keymat of the present invention further includes all the required circuitry to control all the components on the integrated keymat in order to minimize the number of electrical contacts to the keymat down to a few power supply contacts and data line contacts.

It is possible that the integrated keymat also includes one or more transparent, magnifying pads to magnify the legends on the keypads or the legends on a display area.

It is also possible that the emissive keypads be separately integrated into a circuit board having a control circuit which controls the activation of the light-emitting components, wherein the circuit board can be rigid, flexible or of any other form.

The present invention will become apparent upon reading the description taken in conjunction with Figures 1 to 11b.

Brief Description of the Drawings

Figure 1a is a diagrammatic representation showing the preferred embodiment of the integrated keymat, according to the present invention, wherein the light-emitting layer in the keypad is made of an organic light-emitting material.

Figure 1b is a diagrammatic representation showing the same embodiment with the light-emitting layer being made of an inorganic light-emitting material.

Figure 1c is a diagrammatic representation showing another embodiment of the integrated keymat.

Figure 2a is a diagrammatic representation illustrating the light-emitting layer is effectively a single pixel or segment.

Figure 2b is a diagrammatic representation illustrating the keypad effectively comprising two segments, which can be selectively activated.

Figure 2c is a diagrammatic representation illustrating the keypad effectively comprising a plurality of segments, which can be selectively activated, arranged into a matrix.

Figure 3a is a diagrammatic representation illustrating the keypad effectively comprising a plurality of segments, which can be selectively activated to form a numeral.

Figure 3b is a diagrammatic representation illustrating the keypad effectively comprising a plurality of segments, which can be selectively activated to form an

alphanumeric symbol.

Figure 4 is a diagrammatic representation showing the integrated keymat having means to activate a plurality of contact switches in an electronic device.

5 Figures 5a is a diagrammatic representation illustrating the integration of an integrated keymat with an LCD flex.

Figure 5b is a diagrammatic representation illustrating the integration of a plurality of emissive keypads into an LCD flex.

Figure 6a is a front view illustrating an integrated keymat, which can be used on a portable communications device.

10 Figure 6b is a front view illustrating the integrated keymat of Figure 6a showing different keypad functions.

Figure 7a is a front view illustrating an integrated keyboard having a display area, wherein the keypads are placed at one location.

15 Figure 7b is a front view illustrating the same integrated keyboard, wherein the keypads are placed at another location.

Figure 8a is a diagrammatic representation illustrating a transparent, lens-like pad provided on a keypad, which is made on a top layer having recesses.

Figure 8b is a diagrammatic representation illustrating a transparent, lens-like pad provided on a keypad, which is made on a flat top layer.

20 Figure 8c is a diagrammatic representation illustrating a plurality of transparent, lens-like pads provided on one keypad.

Figure 9 is a diagrammatic representation illustrating an integrated keymat having a plurality of transparent, lens-like pads.

25 Figure 10a is a front view illustrating an integrated keymat having a plurality of transparent, lens-like pads being used on a portable communication device.

Figure 10b is a front view illustrating the use of transparent, lens-like pads on the portable communication device.

Best Mode for Carrying Out the Invention

30 Figure 1a illustrates an integrated keymat 10 having a plurality of emissive

keypads **20** to be used on a portable electronic device. The keymat **10** includes a top layer **30** which can be formed from a plastic sheet or any other suitable material. Preferably, the top layer **30** is reasonably flexible to allow a user to push the keypads **20** downward to select a function or enter a value into the electronic device. The top layer has a masking layer **32** to provide a legend or a marking **34** (see Figures 2a-2b) to each keypad **20**. As shown, the top layer **30** has a plurality of recesses **31** for forming the keypads **20**. It is preferable that the keypads **20** be partially filled with a transparent or translucent plastic filling **36**, or any other suitable material such as glass, metal and ceramic, to add mechanical strength to the individual keypads **20**.

To make the keypads **20** emissive, a transparent top electrode layer **38**, a light-emitting layer **40**, and a bottom electrode layer **42** together form a light-emitting source **43** (see Figures 2a-2c) for each keypad **20**. The top electrode layer **38** can be deposited directly on the filling **36**, followed by the placement of the light-emitting layer **40** and the bottom electrode layer **42**. Alternatively, one or more of the components, including the top electrode layer **38**, the light-emitting layer **40** and the bottom electrode layer **42**, can be introduced as a solid form into the recess **31**. The light-emitting source **43** can be a single pixel, as shown in Figure 2a, or a plurality of segments, as shown in Figures 2b, 2c, 3a and 3b. Preferably, the light-emitting layer **40** is made from one or more organic materials. The organic materials can be molecular, and they can be directly deposited into the inside of the keypad by vacuum evaporation or sublimation. The organic materials can also be polymeric, commonly known as light-emitting polymers (LEPs), and they can be printed within the recess **31** of the keypad **20** with an inkjet printer or a similar machine. Devices based on the organic light-emitting materials are also known as organic light-emitting devices (OLEDs), as opposed to regular LEDs, which are made of inorganic materials. Alternatively, the light-emitting layer can be made of screen-printed electroluminescence (EL) pixels, inorganic LEDs or other discrete light-emitting devices, as shown in Figure 1b. It is preferred that the light-emitting layer **40** be hermetically sealed with an encapsulation material **44**, with only the electrical connections to the light-emitting layer **40** being exposed to the outside of the

encapsulation. If necessary, an extension electrode 46 is provided to electrically expose the top electrode 38 outside the encapsulation material 44 for electrical connections. Preferably, a gap 45 is provided between the encapsulation material 44 and the light-emitting layer 40 for filling therewith one or more protective gases 145, such as nitrogen (N₂) and argon (Ar). It should be noted that it is possible to fabricate the light-emitting source 43, which includes the electrodes 38, 42, 46 and the light-emitting layer 40, separately from the top layer 30 and secure this illuminating source to the recess 31. As shown in Figure 1a, the keymat 10 further comprises electrical connectors 50, 52 for providing electrical power to the light-emitting source 43 for activating the light-emitting layer 40. It is preferred that the emissive keypads 20 are individually addressable so that they can be selectively illuminated.

Figure 1b illustrates a keymat 10', which is basically the same as the keymat 10 shown in Figure 1a, except that the light-emitting layer is not organic. As shown in Figure 1b, the light-emitting layer 40' can be made of screen-printed electroluminescence (EL) pixels, inorganic LEDs or other discrete light-emitting devices. With these inorganic light-emitting materials, it may not be necessary to provide a gap 45 between the encapsulation layer and the light-emitting layer for filling with a protective gas. Thus, as shown in Figure 1b, it is possible to have an encapsulation layer 44' to be provided directly on the bottom electrode layer 42 and in contact with the light-emitting layer 40'.

Figure 1c illustrates a keymat 10'', which is basically the same as the keymat 10 shown in Figure 1b, except that the top layer 30' is substantially flat and has no recesses. As shown in Figure 1c, the light-emitting source 43, which includes the top electrode layer 38, the light-emitting layer 40 and the bottom electrode layer 42, can be implemented directly on the top layer 30', without the need of the filling 36. Likewise, the encapsulation layer 44 is directly provided on the top layer 30'.

Figures 2a to 2c illustrate different configurations of the emissive keypads. As shown in Figure 2a, the light-emitting source 43 comprises basically a single light-emitting pixel for illuminating substantially the entire surface of a keypad 20. In that case, it is preferable to have a masking layer 32 which includes clear and opaque areas

to form a clear pattern for the text, legend or symbol that is used as the marking 34. As shown in Figure 2a, the marking 34 is a letter "a".

As shown in Figure 2b, the top transparent electrode layer 38 includes two top transparent electrodes 38a and 38b, and the light-emitting source 43' effectively comprises two light-emitting pixels or segments: one defined by the top transparent electrode layer 38a and one defined by the electrode layer 38b. The top electrodes 38a, 38b are selectively controllable so that one or both pixels thereunder can be activated to illuminate one or more segments of the keypad surface. In that case, the marking 34 above the illuminating source can have one or more legends or symbols 34a, 34b. For example, when the bottom electrode 42 and the top electrode 38a supply electrical power to activate the light-emitting layer 40, 40', the legend "HI" of the marking 34 is illuminated. Likewise, when the bottom electrode 42 and the top electrode 38b supply electrical power to activate the light-emitting layer 40, 40', the legend "LO" of the marking 34 is illuminated.

It is possible for the light-emitting source 43" to be effectively produced as a matrix of pixels or segments, as shown in Figure 2c. To illustrate the pixel matrix, Figure 2c simplistically depicts a matrix of 4x4 pixels which can be selectively activated by a group of four top electrodes 38' and a group of four bottom electrodes 42'. The individual pixels in the light-emitting layer 40 are addressable by a control circuit (not shown) through the electrodes 38' and 42'. In this case, it is possible to form a symbol or legend by selectively activating the pixels, and the masking layer 32 may simply have a window 34c to define the keypad surface area, as shown in Figure 2c.

It is also possible for the light-emitting source to be produced as a segmented-type display. As shown in Figure 3a, the light-emitting source 43a effectively comprises seven segments 471, 472, ..., 477, which are individually addressable so that they can be selectively activated to form a numeral. Alternatively, the light-emitting source 43b can have sixteen segments 481, 482, ..., 496, which are individually addressable so that they can be selectively activated to form an alphabetical letter, a numeral or a simple mathematical symbol, as shown in Figure

3b.

The group of pixels, as shown in Figures 2b and 2c, or the group of segments, as shown in Figures 3a and 3b, can be addressed passively (passive-matrix addressing) or actively (active-matrix addressing). Preferably, these pixels or segments are implemented using organic light-emitting materials.

Currently, very high-resolution, small, inorganic emissive displays can be produced using the active-matrix electroluminescence (AMEL) technology. Products with a 640x480 pixels resolution on an active area of approximately 1.55x1.14 cm² are already available. The AMEL technology can also be used to produce the light-emitting source 43 for the individual keypads 20.

With a sufficiently large number of pixels in each light-emitting source 43, the same keypad 20 can be programmed to show different texts or graphics (see Figures 7a and 7b), if so desired. Such a matrix-type light-emitting source, or the segmented-type light-emitting source, as shown in Figures 3a and 3b, can help achieve a user-interface (UI)-style keymat, with just a few emissive keypads 20. These matrix and segmented-types of light-emitting sources make it easy to change the operating modes of an electronic device from one to another without changing the keymat. For example, the same electronic device can be used as a mobile phone, a PDA or a sophisticated calculator. Furthermore, the matrix or segmented light-emitting source allows the user to program each and every key of an electronic device to show the function for each key in a specific situation. Likewise, the matrix or segmented light-emitting source allows the user to place a keyboard at different positions on an electronic device. For example, the keyboard can be placed to the right of the main display or to the left of the main display. The keyboard can also be placed below or above the main display, with the text on the keypads oriented in the same direction as the text on the main display, as shown in Figure 8a and 8b.

Figure 4 is a diagrammatic representation of a section of a keyboard 5, which includes an integrated keymat 10 implemented on top of a circuit board 100. Usually, each keypad 20 allows a user to select a function or key in a value through a switch 110 on the circuit board 100. As shown in Figure 4, a plurality of switch activation

pins 22 are provided to the keypads 20 to allow a user to selectively activate the switches 110. The switches 110 shown in Figure 4 are contact switches that have mechanical components on them. However, it is possible to use touch-sensitive switches instead. In that case, it is also possible to provide one or more capacitive/conductive elements (not shown) on or near the keypad 20 so as to allow the user to activate a switch, in a manner similar to a touch-screen. The mechanical and touch-sensitive switches are well known in the art.

The integrated keymat 10 can be integrated onto an LCD flex 120, which includes a circuitry section 130 and an LCD display panel 140, as shown in Figure 5a.

The circuitry section 130 contains a drive circuit to drive the LCD panel 140 and a control circuit to selectively address the light-emitting source 43 (Figures 2a to 3b) to illuminate the keypads 20. By integrating the keymat 10 onto the LCD flex 120, it is possible to print the electrical connectors 50, 52 directly onto the circuitry section 130, along with the LCD drive electronics, thereby minimizing the number of electrical contacts to the keymat 10 down to a few power supply contacts (2 contacts, for example) and data line contacts (one or more).

It is also possible to integrate the individual emissive keypads 20 (or 20') onto an LCD flex 120, as shown in Figures 5a and 5b, or onto a separate flexible/rigid substrate (not shown) with a self-contained electronic circuitry. The essential components of each emissive keypad 20 include a top layer 30, a transparent top electrode layer 38, a light-emitting layer 40 (or 40'), a bottom electrode layer 42 and the encapsulation layer 44 (or 44') (Figure 1a or 1b). For supplying electrical power to the light-emitting layer 40, it is preferred that the electrical connectors 50, 52 be printed on the LCD flex 120, or the separate flexible/rigid substrate. Furthermore, it is preferred that the LCD flex 120 or the separate substrate be provided with a self-contained electronic circuitry.

The integrated keymat 10, 10' (Fig. 5a) can be used on a mobile telephone. For example, the integrated keymat can be integrated into the front cover of the mobile telephone. The integrated keymat has a plurality of emissive keypads 20 (or 20'), each having a light-emitting source 43 (Figures 2a - 3b) that can be selectively

activated to illuminate the keypad so that the legend on the keypad will become more distinguishable when the ambient light is not adequate. The legend can be a symbol such as “#”, text such as “OK”, or a combination of alphanumeric symbols such as “5jkl” that are usually used on a mobile phone. It is possible to paint the top layer 30 (Figure 1) of the keymat 10 with different colors to obtain a suitable color and appearance of the key.

Figures 6a and 6b illustrate an integrated keymat 13 that is integrated into the front cover 160 of a portable communication device. As shown in Figures 6a and 6b, the integrated keymat 13 includes a plurality of emissive keypads 20a-20h. It is possible to use a plurality of pixels, as shown in Figure 2c, or segments, as shown in Figures 3a and 3b, to form the legend of the emissive keypads 20a-20h so that the legend can be changed to show different functions associated with the keypads 20a-20h. For example, the portable communications device can be operated in a “Browser” mode, as shown in Figure 6a, or in a “Phone” mode, as shown in Figure 6b. When the device is operated in the “Browser” mode, the display panel 162 can be used to display a web-page, for example. The display panel 162 can be used to display a plurality of softkeys 170-174, legends or text 176, 180, graphics 182 and images 184. Accordingly, the legends on the emissive keypads 20a-20h can be programmed to show a plurality of browser-related functions such as “Home”, “Search”, “Favorite”, etc. But when the device is operated in the “Phone” mode, the display panel 162 can be used to display telephone-related information, and the legends on the emissive keypads 20a-20h can be programmed to show a plurality of mobile phone-related functions such as “Menu”, “ok”, etc. Also, there is an emissive keypad 20d, which is programmed to show a “www” function, allowing the user to switch the device from the “Phone” mode back to the “Browser” mode for fast access to the Internet.

Figures 7a and 7b illustrate an integrated keymat 15 that is integrated into an electronic device 200. As shown, the electronic device 200 has a large keypad 230 and group of keypads, collectively denoted by numeral 240. The keypad 230 has a sufficiently large number of pixels such that the keypad 230 can be used as a display

device. The display area of the keypad **230** can be divided into a main display area **250** and a soft keyboard **260**. The soft keyboard **260** includes a plurality of softkeys, collectively denoted by numeral **270**. The soft keyboard **260** can be placed at different locations relative to the main display area **250**. As shown in Figure 7a, the soft keyboard **260** is located below the main display area **250**. As shown in Figure 7b, the soft keyboard **260** is located above the main display area **250**. For example, the location of the soft keyboard **260** relative to the main display area **250** can be changed by using a keypad **242** which is located outside the keypad **230**. However, the keypad **242** can be implemented as a softkey within the display area of the keypad **230**.

Figure 8a shows that a transparent, lens-like pad **60** is provided on the keypad **20** (or **20'**) of the integrated keymat **10** (or **10'**) in order to magnify the legend or marking **34** (see Figures 2a and 2b). The transparent, magnifying pad **60** can be molded out of the top layer **30**, or provided on the surface of the top layer **30**. Thus, the pad **60** and the top layer **30** can be made of the same material or different materials.

Likewise, the transparent, magnifying pad **60** can be provided on the keypad **20** of the integrated keymat **10''**, as shown in Figure 8b. The magnifying pad **60** can be produced directly on the top layer **30'**, or it can be produced separately from the top layer **30'** and attached thereon in a separate process. The magnifying pad **60**, as shown in Figures 8a and 8b, can be used on the integrated keypad **13** to make the legends on the keypads **20a**, ..., **20g**, as shown in Figures 6a and 6b, more legible.

It is possible that two or more magnifying pads **60a**, **60b** be made on one keypad **20**, as shown in Figure 8c. In this way, the magnifying pads **60a**, **60b** can be used to separately magnify the different legends or symbols on the same keypad. For example, the magnifying pads **60a**, **60b** can be used to separately magnify the legends **34a**, **34b**, as shown in Figure 2b.

It is also possible to provide one or more magnifying pads **60**, **62** on the top layer **30** of an integrated keymat **13**, as shown in Figure 9. As shown, the magnifying pads **60** are provided on the keypads **20** but the magnifying pads **62** are provided on a clear area **70** of the integrated keymat **13**. As shown in Figure 10a, the clear area **70**

corresponds to a section of the display panel 162. This section of the display panel 162 can be used to display softkeys 170, 172, 174 and text 176, as shown in Figure 10b. As shown in Figure 10b, the magnifying pads 62 make the legends on the softkeys 170, 172, 174 and the text 176 more legible. The magnifying pads 60 make
5 the legends on the regular keys 20a, ..., 20g more legible.

Thus, the present invention has been disclosed according to a number of embodiments of the integrated keymat, which includes one or more emissive keypads, with the keypads being individually addressable. The light-emitting source in the keypad can comprise a single pixel, two or three pixels, or a large number of pixels
10 organized into a matrix. Likewise, the light-emitting source in the keypad can comprise a plurality of segments to form a segmented type display. That the keypads of an electronic device are selectively illuminated can help guide a user to operate the device. By integrating the light-emissive components onto the keypads, the illumination of the keymat becomes more power-efficient. Emissive keypads having
15 two or more legends selectively shown thereon can be used to replace softkeys.

Although the invention has been described with respect to the preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and various other changes, omissions and deviations in the form and detail thereof may be made without departing from the spirit and scope of this invention.

What is claimed is:

1. An integrated keyboard to be used in an electronic device including at least one keypad having a key indicating mark provided thereon, said keyboard comprising:

5 a substrate;

at least one light-emitting source provided to illuminate the keypad; and

a plurality of electrodes, operatively connected to a power source, to activate the light-emitting source, wherein the connection of the electrodes is controllable so that the light-emitting source can be activated to illuminate the keypad causing the key indicating mark on the keypad to become more visible.

2. The keyboard of claim 1, wherein the light-emitting source in the keypad comprises a single light-emitting pixel.

3. The keymat of claim 1, wherein the light-emitting source in the keypad comprises at least two light-emitting segments.

4. The keyboard of claim 3, wherein the segments are individually addressable so as to allow the segments to be selectively activated to illuminate said keypad.

5. The keyboard of claim 3, wherein the segments are individually addressable so as to allow the segments to be selectively activated to form a symbol.

6. The keymat of claim 1, wherein the light-emitting source in the keypad comprises a plurality of pixels organized into a matrix, wherein pixels in the matrix are individually addressable so as to allow the pixels to be selectively activated to form an illuminating pattern.

7. The keyboard of claim 1, wherein the light-emitting source comprises a light-emitting layer which is made of an electroluminescence material.

8. The keyboard of claim 1, wherein the light-emitting source comprises an active-matrix electroluminescence device.

5 9. The keyboard of claim 1, wherein the light-emitting source comprises an actively addressed organic light-emitting device.

10. The keyboard of claim 1, wherein the light-emitting source comprises a passively addressed organic light-emitting device.

10 11. The keyboard of claim 1, wherein the light-emitting source comprises a light-emitting layer which is made of at least one organic light-emitting material.

15 12. The keyboard of claim 1, wherein the light-emitting source comprises a light-emitting layer which is made of at least one inorganic light-emitting material.

13. The keyboard of claim 1, wherein the key indicating mark is changeable to show different functions associated with the keypad.

20 14. The keyboard of claim 1, further comprising at least one magnifying pad provided on the keypad in order to make the key indicating mark more legible.

25 15. The keyboard of claim 1, further comprising an electronic circuit for controlling the electrodes.

30 16. The keyboard of claim 15, further comprising a display panel for displaying information to a user of the electronic device, wherein the display panel is operatively connected to the electronic circuit so as to allow the electronic circuit to drive the display panel.

17. The keyboard of claim 16, wherein the display panel is an LCD panel.

18. The keyboard of claim 16, wherein the display panel displays at least one softkey having a legend indicating a function of the softkey, the keyboard further comprising at least one magnifying pad provided on the softkey to make the legend on the softkey more legible.

19. An emissive keypad to be integrated into a keyboard of an electronic device, wherein said keypad has a symbol indicative of a function of the electronic device, said keypad comprising:

a light-emitting source;

a plurality of electrodes for supplying electrical power to the light-emitting source in order to activate the light-emitting source for making the symbol more visible, where the electrodes are controllable so that the activation of the light-emitting component is selectable.

20. The emissive keypad of claim 19, wherein the light-emitting source comprises a single light-emitting pixel.

21. The emissive keypad of claim 19, wherein the light-emitting source comprises a plurality of pixels organized into a matrix which are individually addressable so as to allow the pixels to be selectively activated to form the symbol.

22. The emissive keypad of claim 19, wherein the symbol is changeable in order to change the function.

23. The emissive keypad of claim 19, wherein the light-emitting source comprises at least two light-emitting segments.

24. The emissive keypad of claim 23, wherein the light-emissive segments are

individually addressable so as to allow the segments to be selectively activated to illuminate said keypad.

5 25. The emissive keypad of claim 23, wherein the light-emissive segments are individually addressable so as to allow the segments to be selectively activated to form the symbol.

26. The emissive keypad of claim 19, wherein the keyboard comprises an electronic circuit for controlling the activation of the light-emitting source.

10 27. The emissive keypad claim 26, wherein the keyboard further comprises a display panel for displaying information to a user of the electronic device, wherein the display panel is operatively connected to the electronic circuit so as to allow the electronic circuit to drive the display panel.

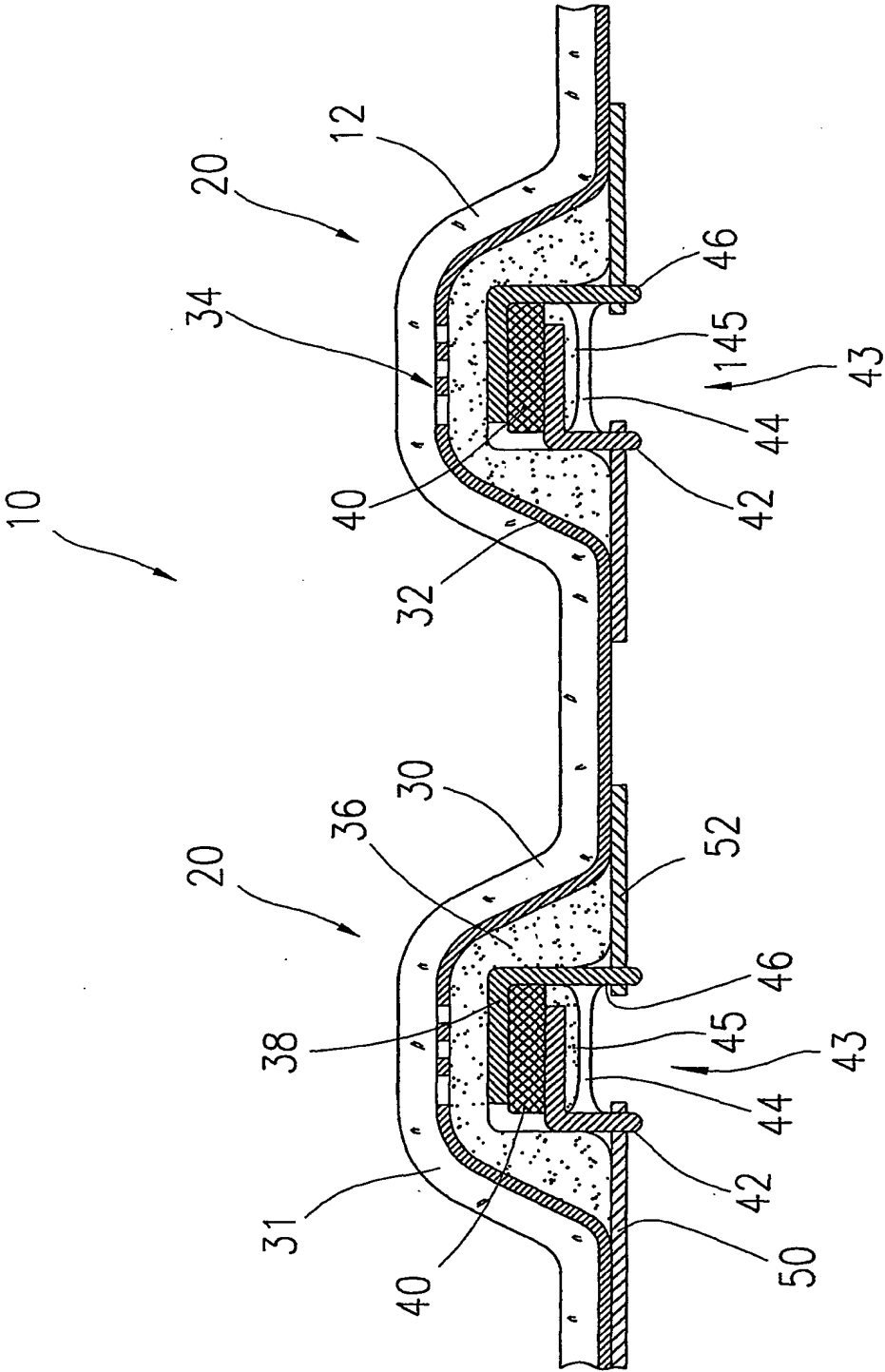


FIG. 1A

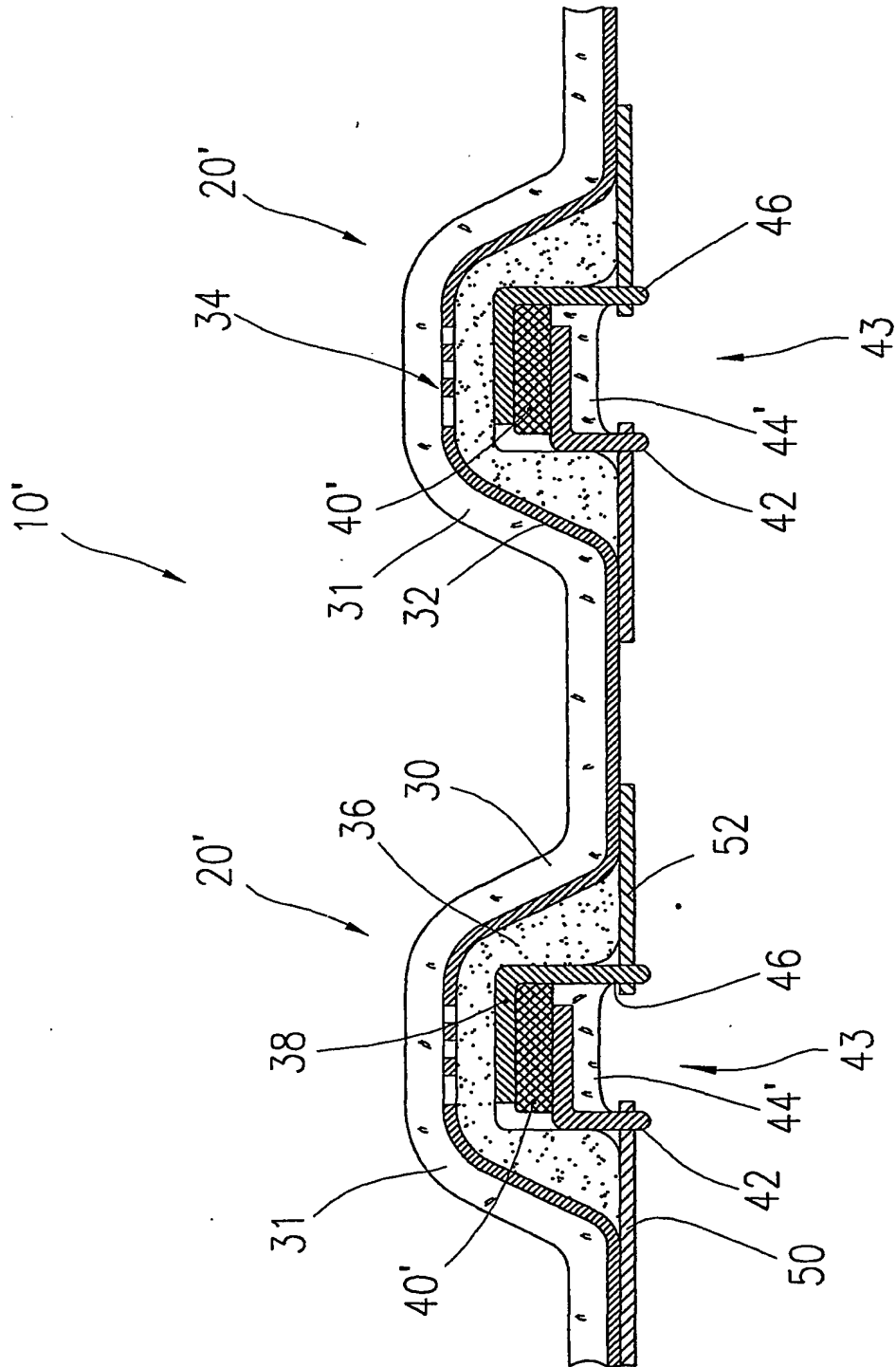


FIG. 1B

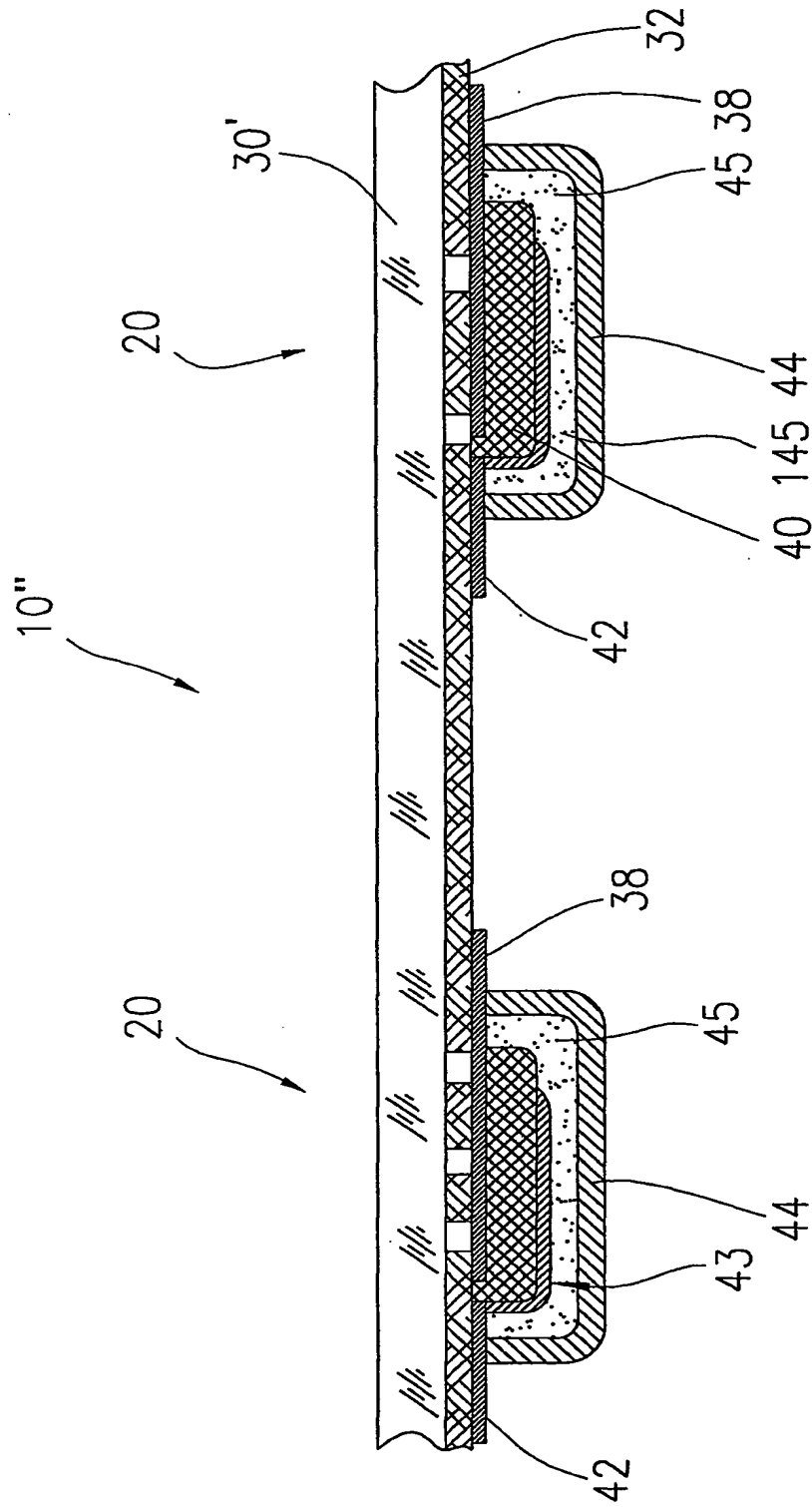


FIG. 1C

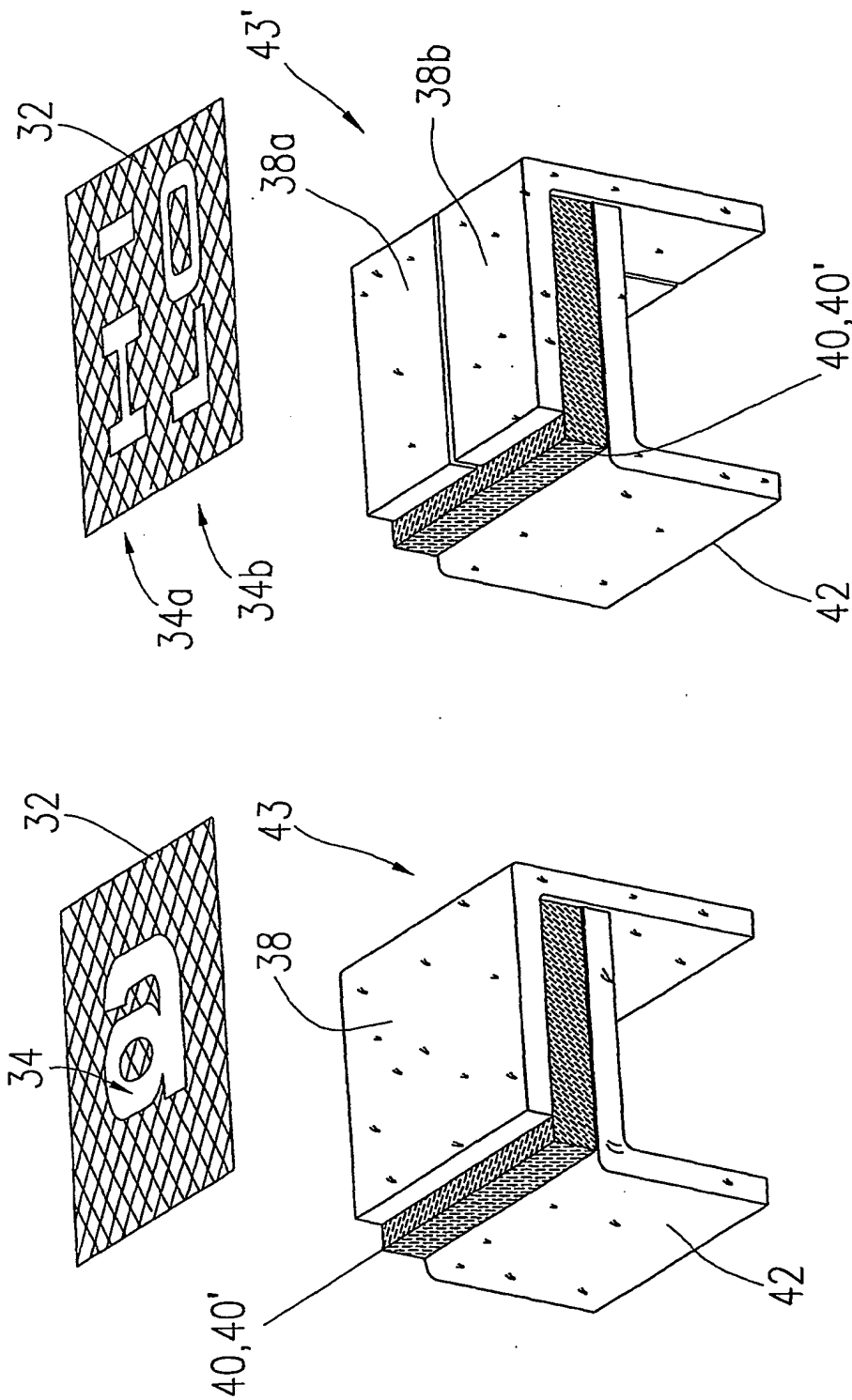


FIG. 2B

FIG. 2A

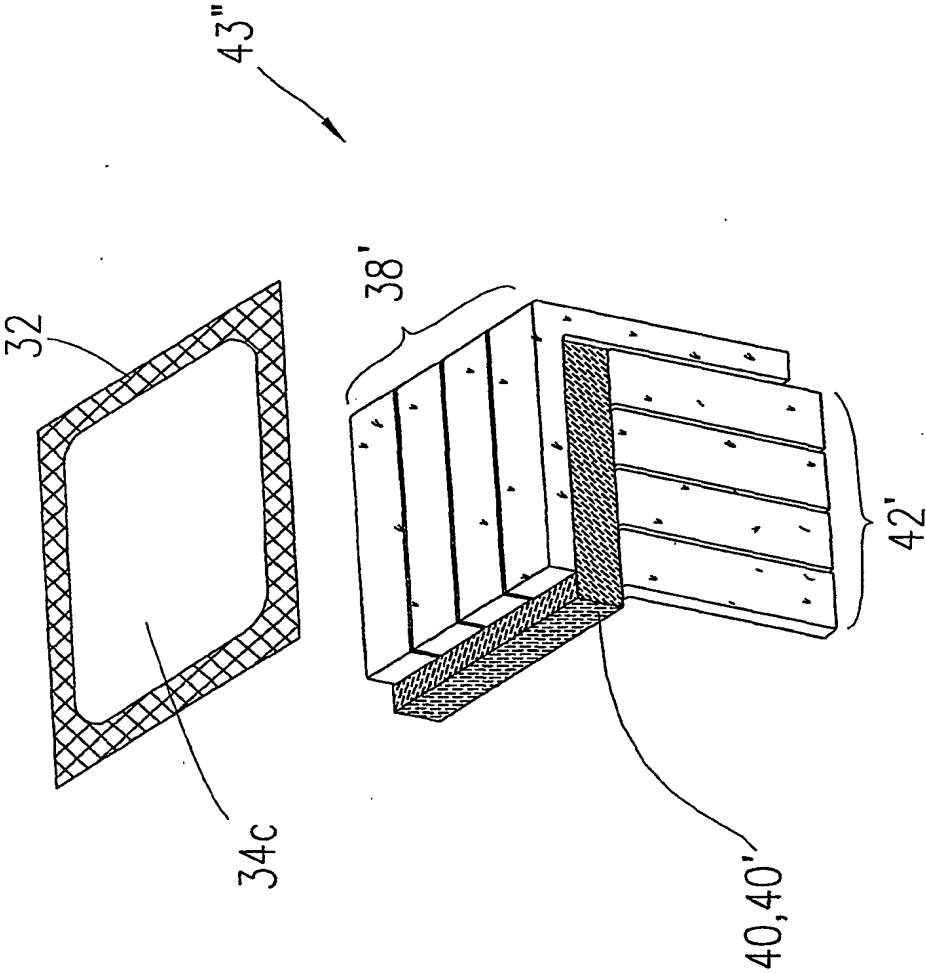


FIG. 2C

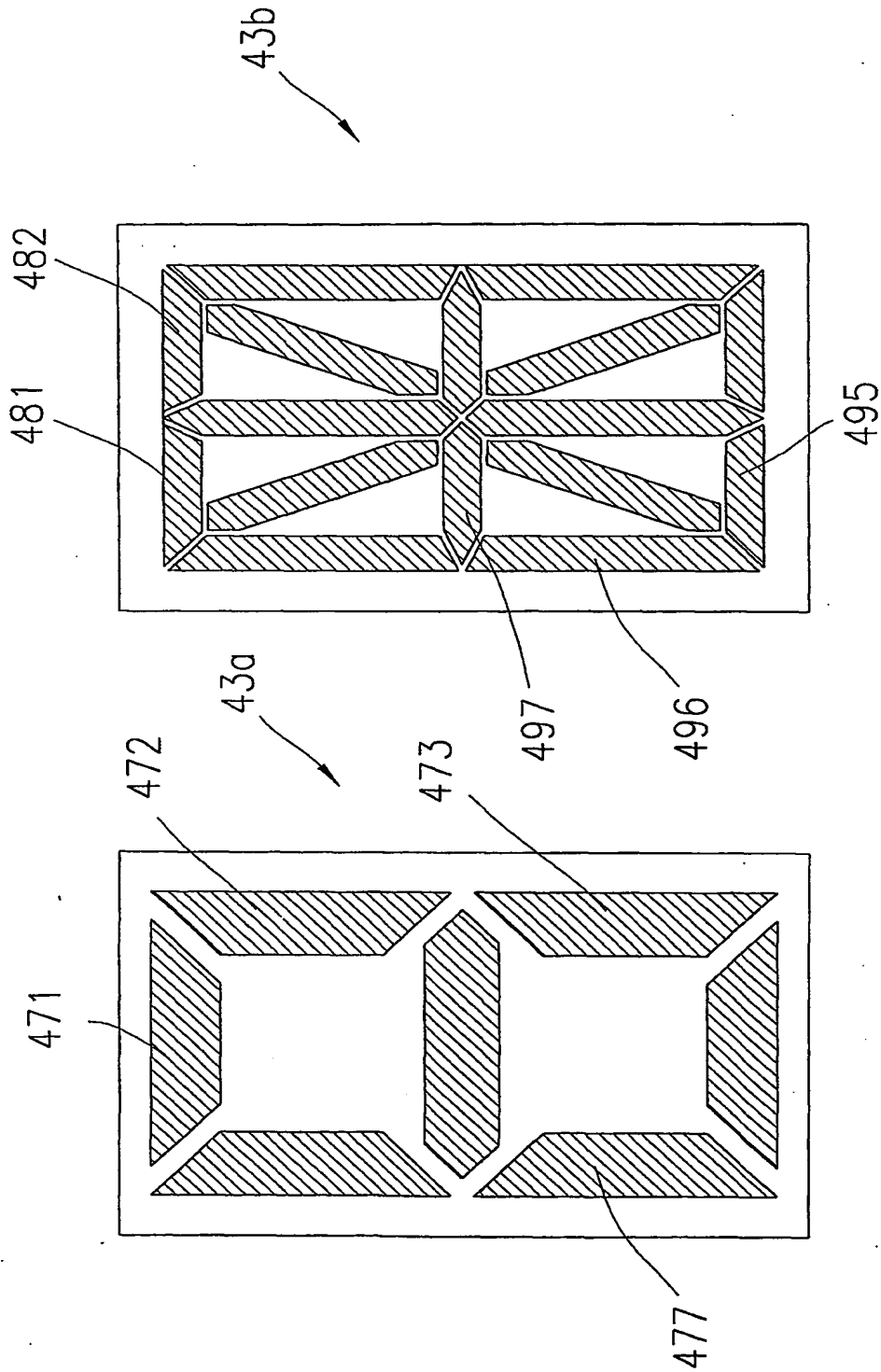


FIG. 3B

FIG. 3A

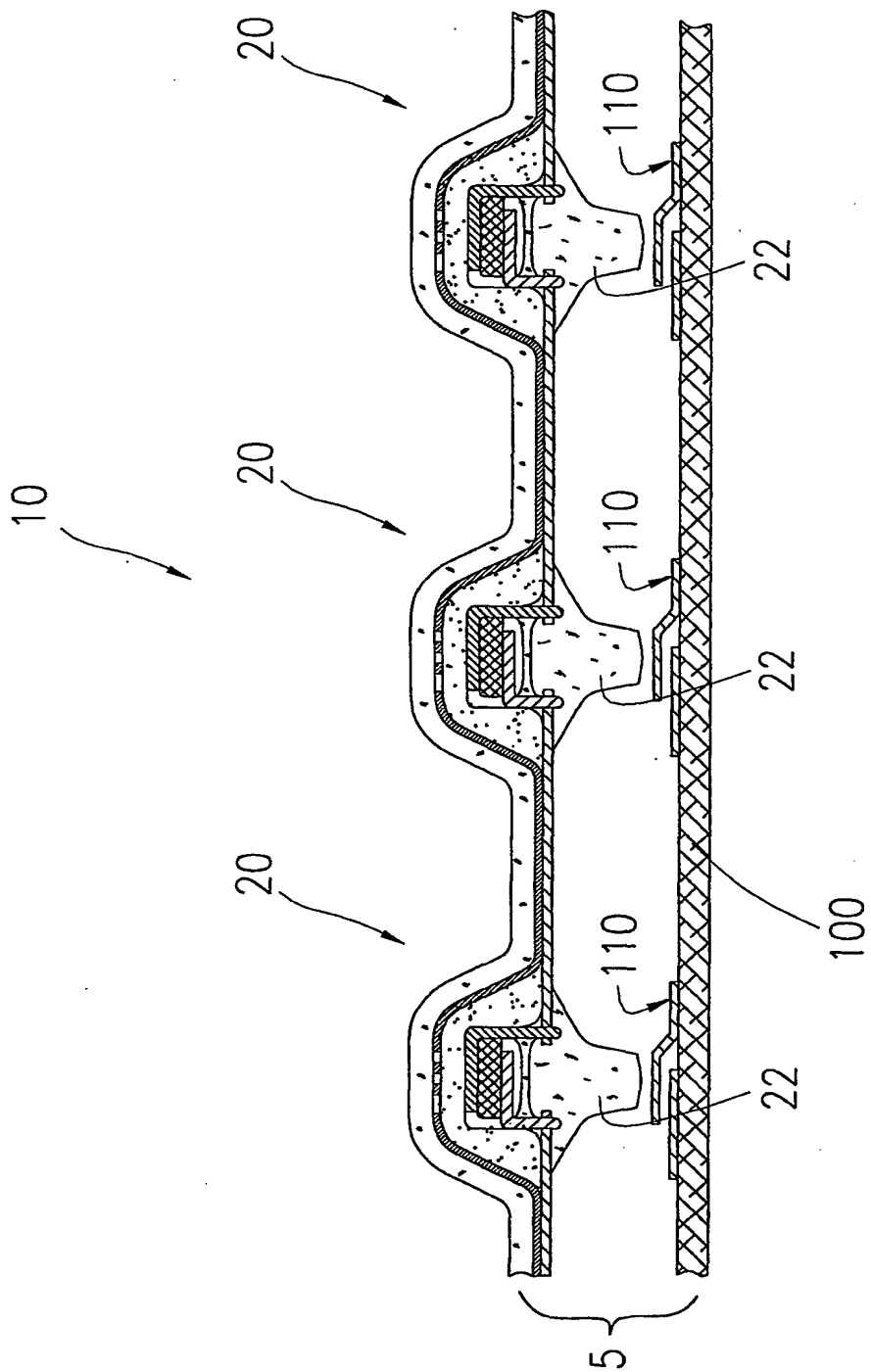
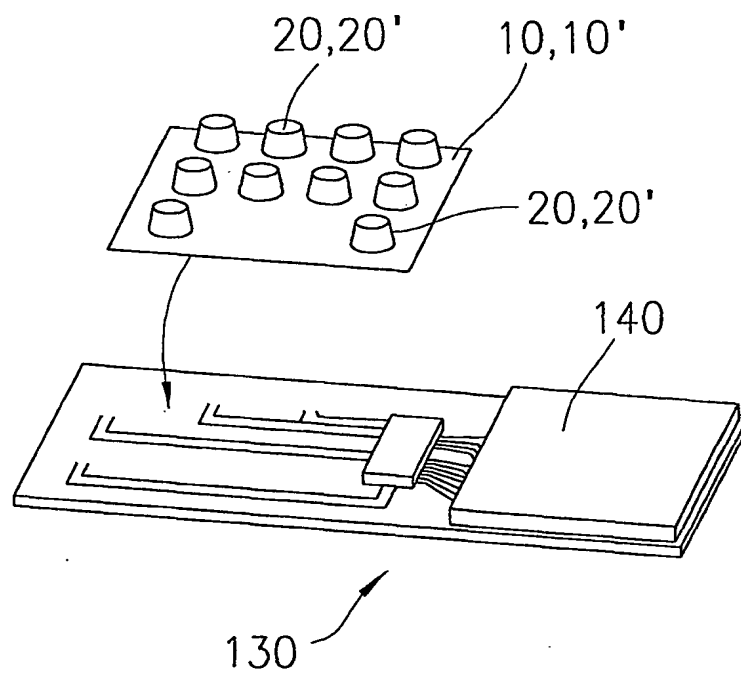
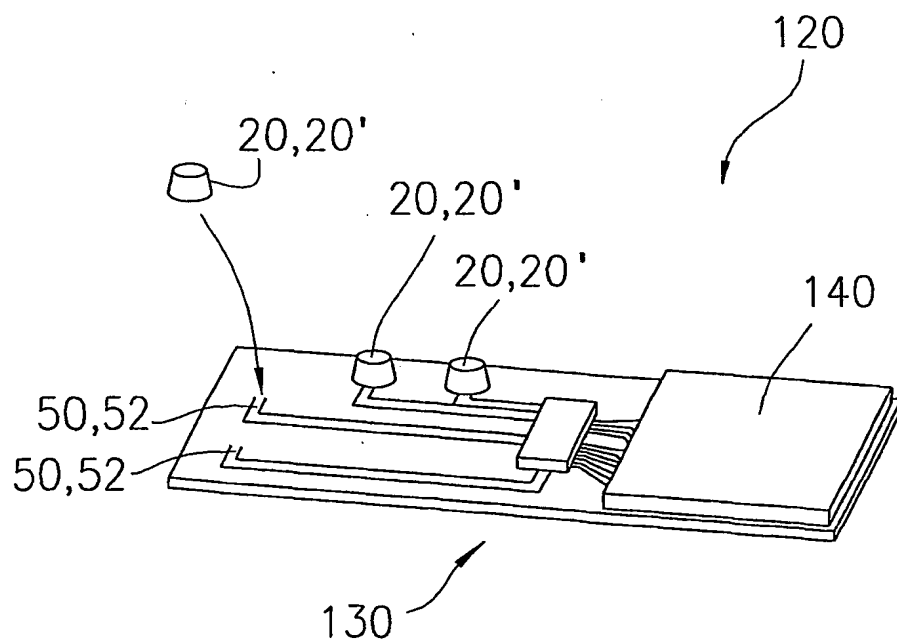
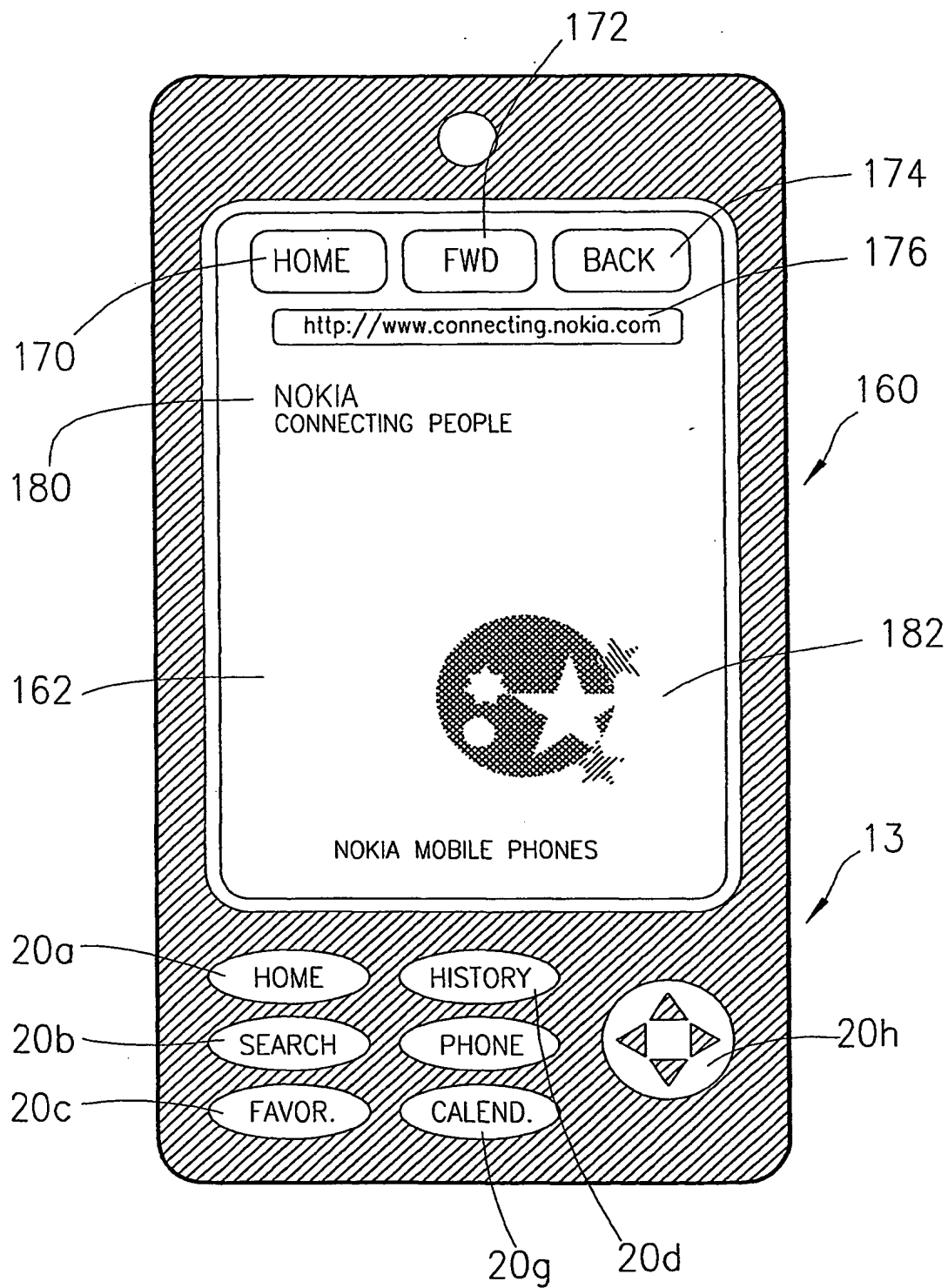
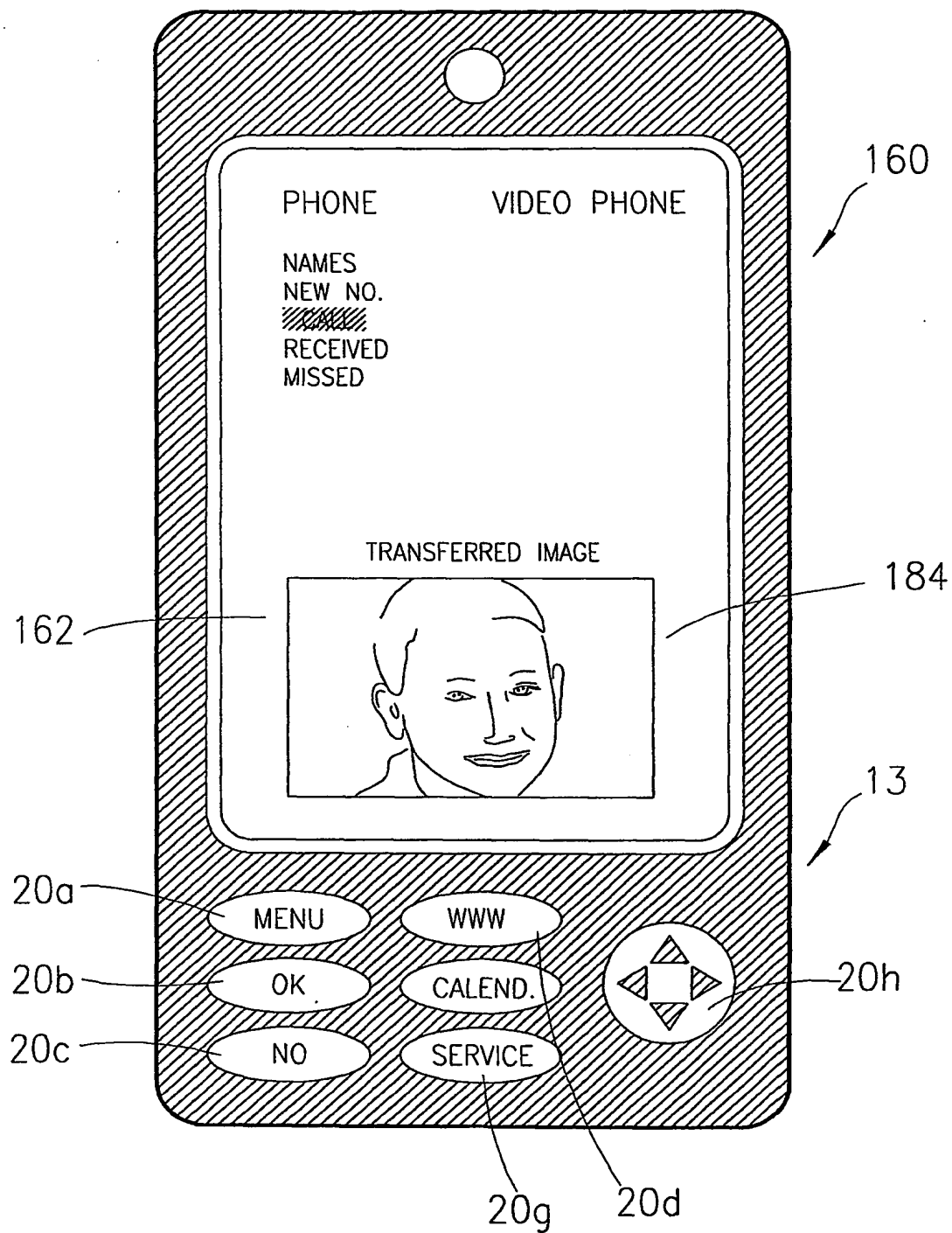
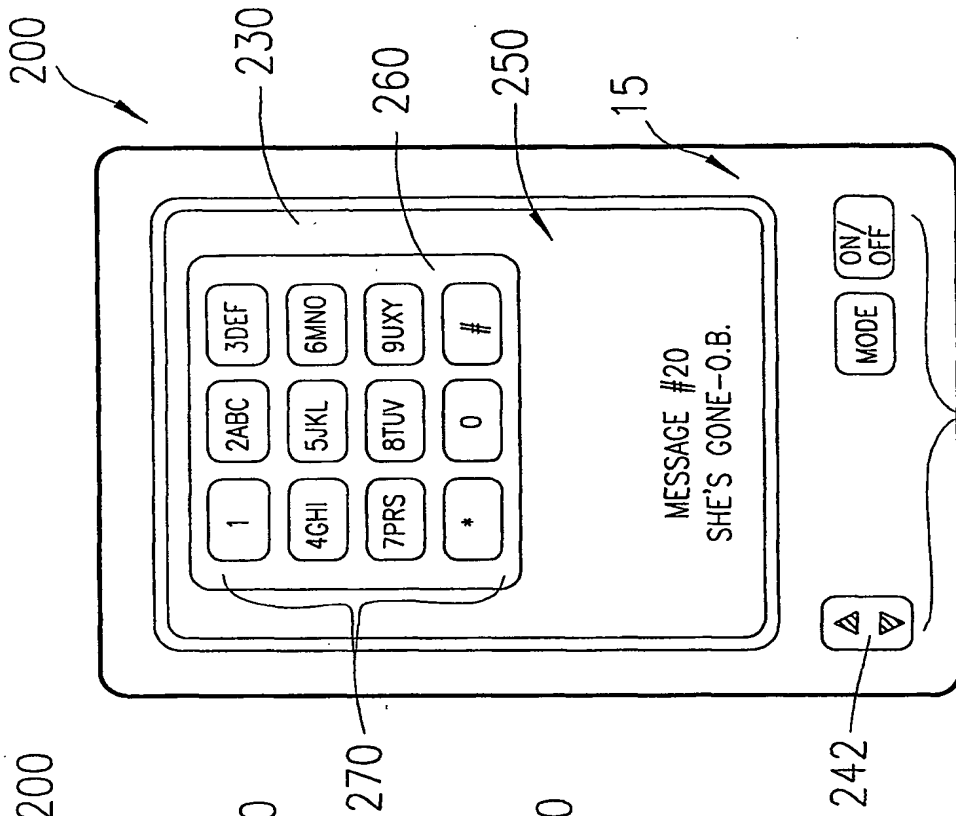


FIG. 4

**FIG. 5A****FIG. 5B**

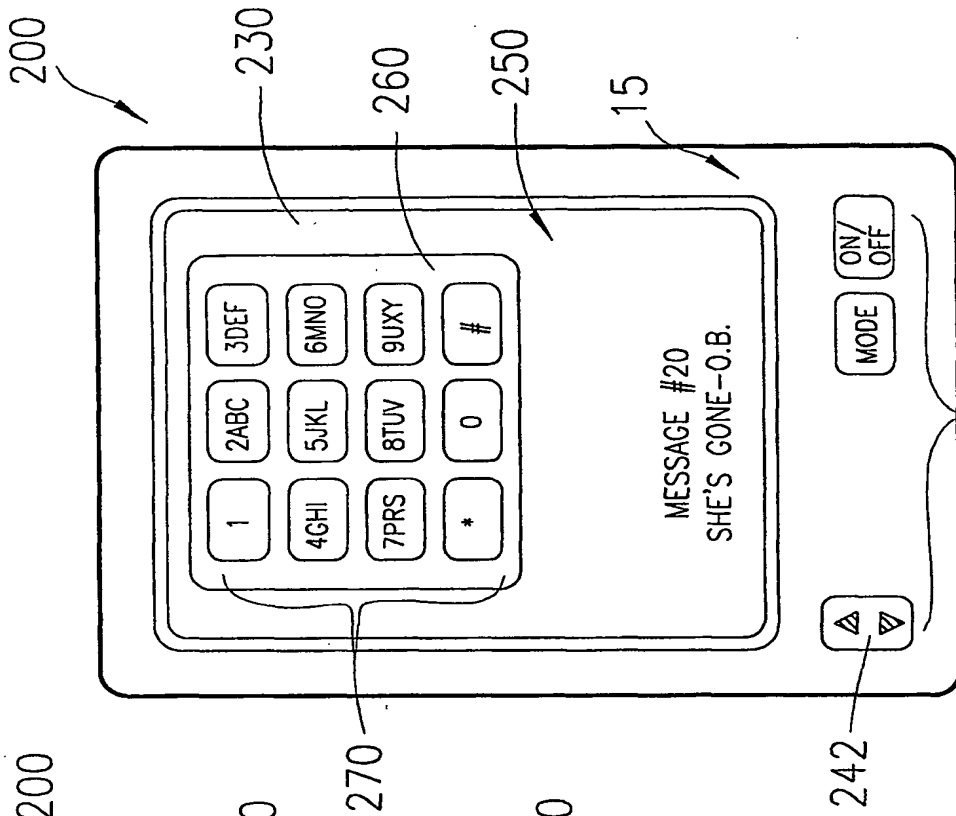
**FIG. 6A**

**FIG. 6B**



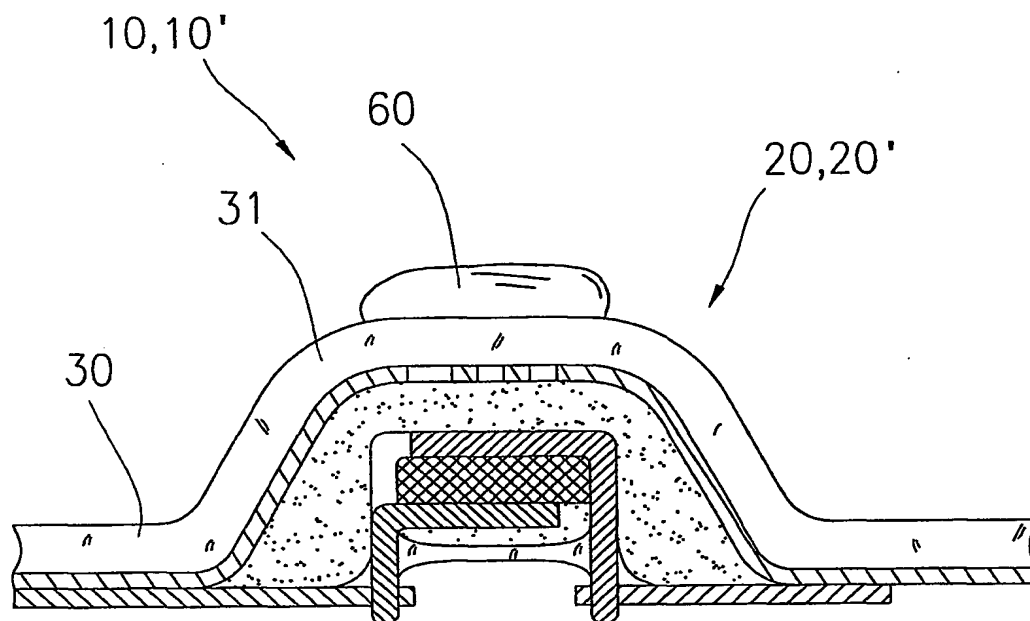
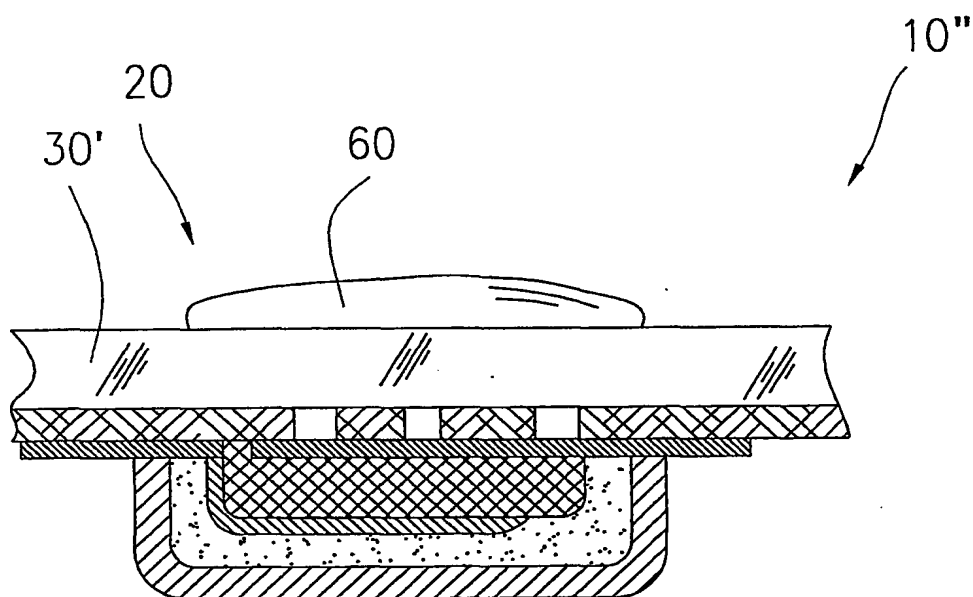
240

FIG. 7A



240

FIG. 7B

**FIG. 8A****FIG. 8B**

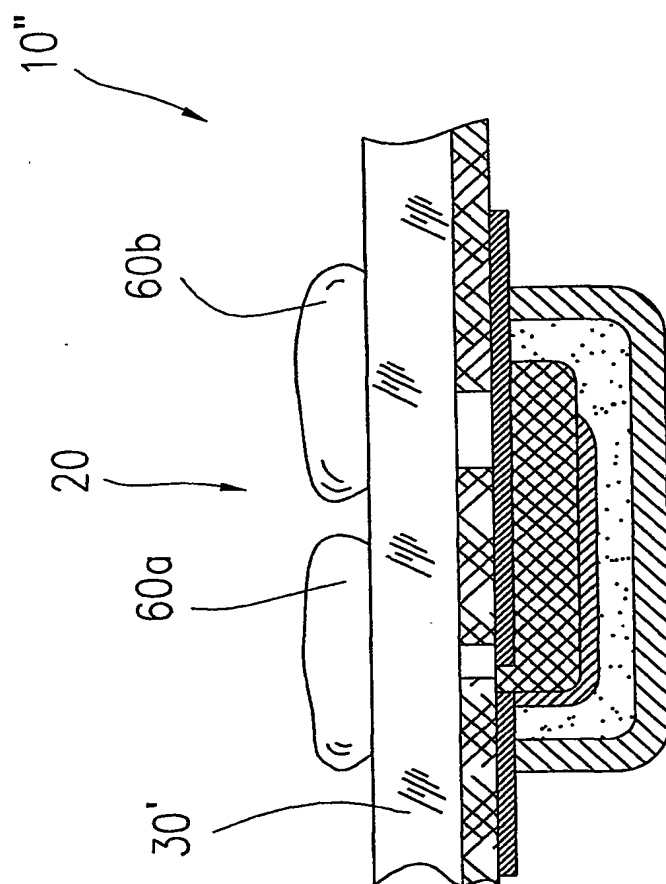


FIG. 8C

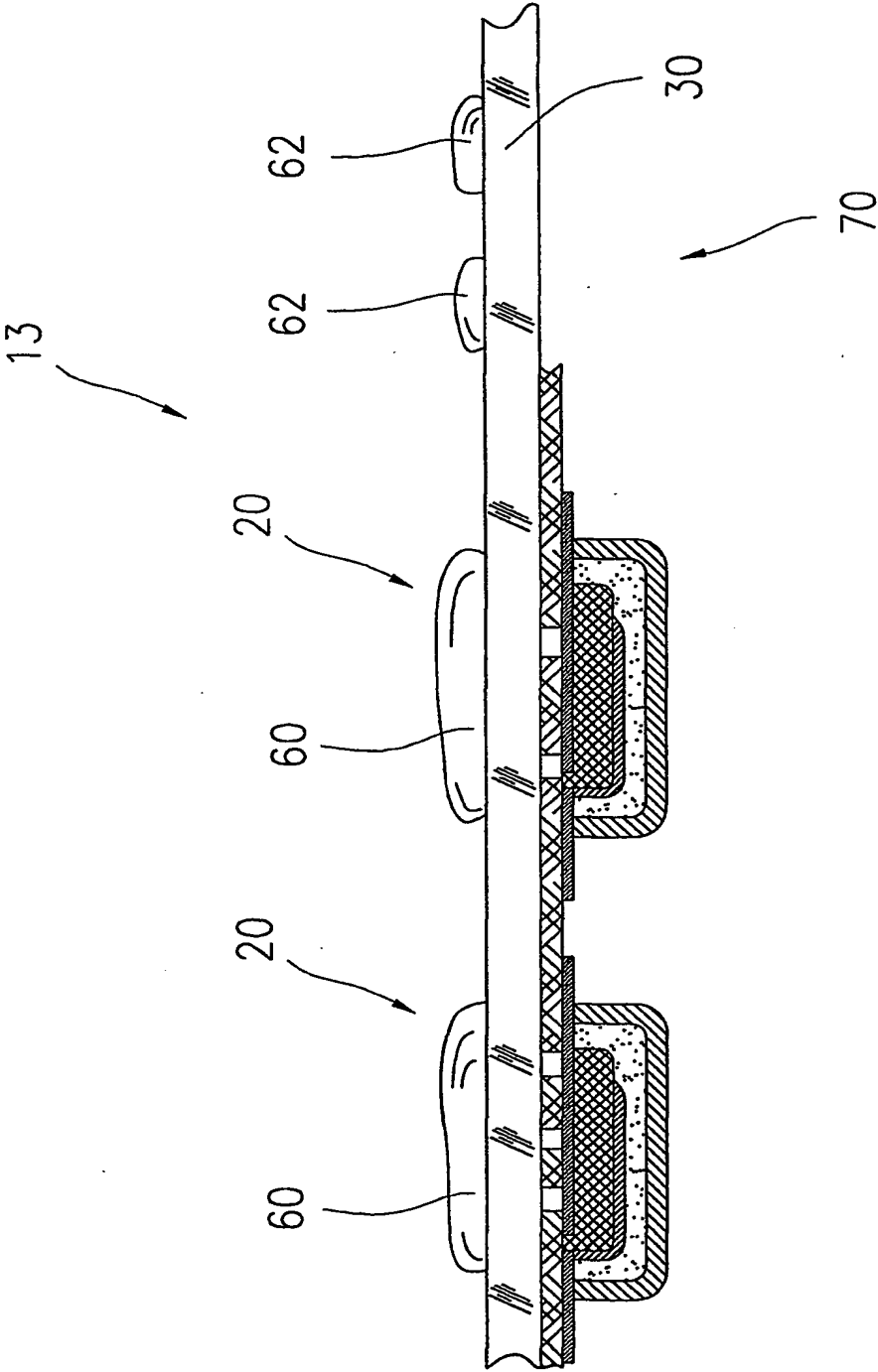
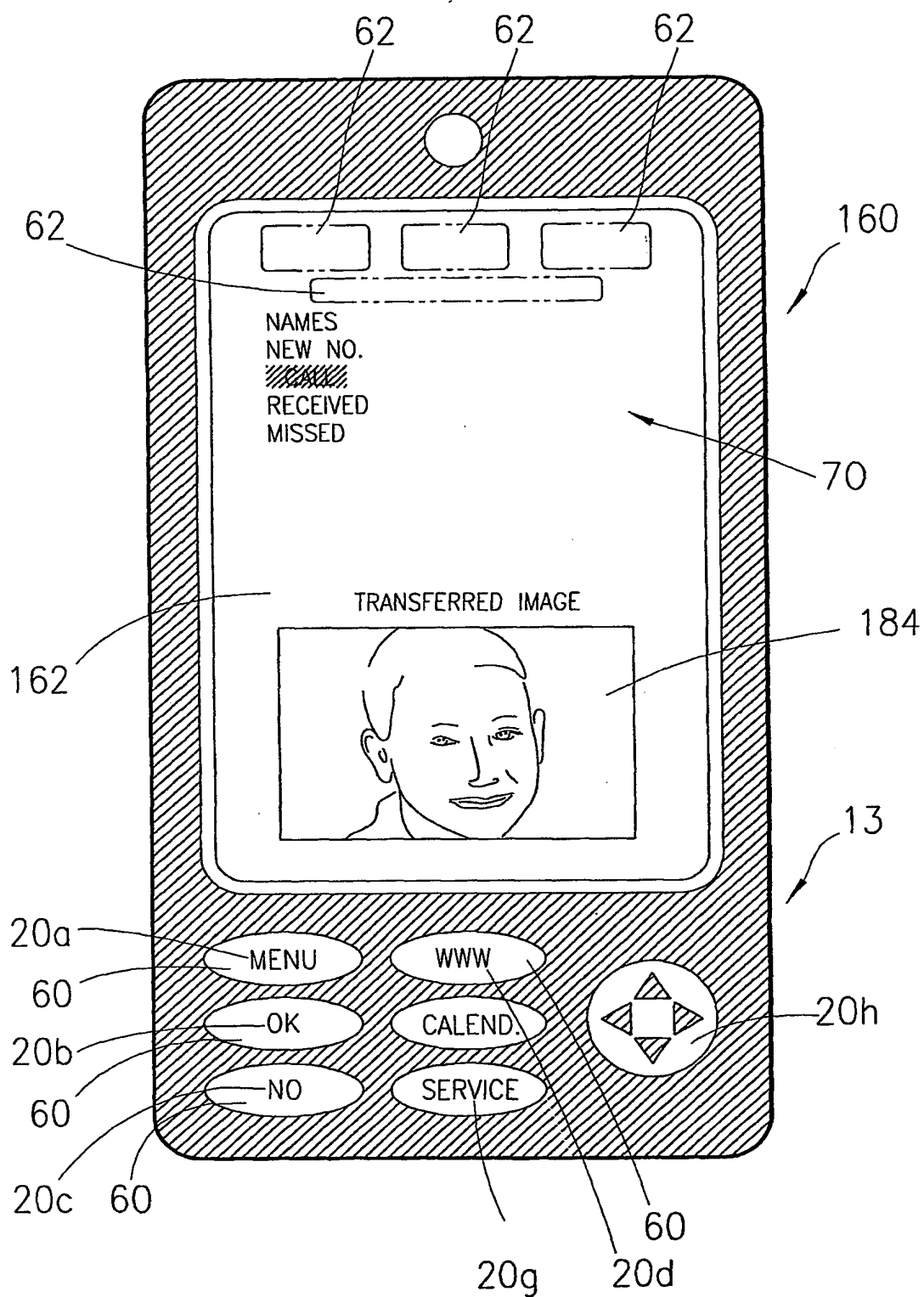
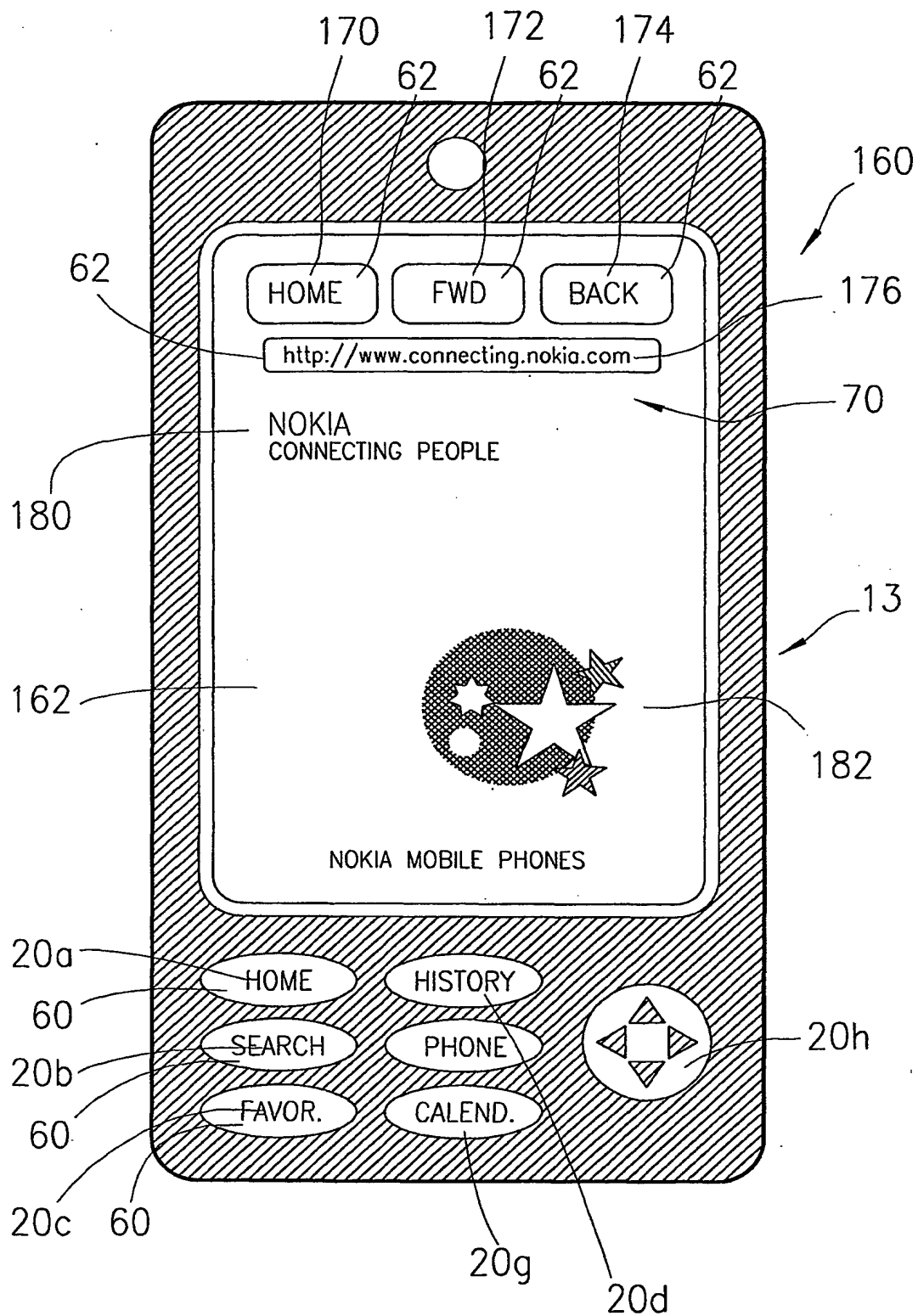


FIG. 9

**FIG. 10A**

**FIG. 10B**

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 01/01483

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01H13/70

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01H H04M G02F H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 09, 30 September 1996 (1996-09-30) - & JP 08 137487 A (TAITO CORP), 31 May 1996 (1996-05-31) abstract	1, 2, 12, 15, 16, 19, 20, 26, 27
X	US 4 022 993 A (SHATTUCK RONALD CORROALLES) 10 May 1977 (1977-05-10) the whole document	1-6, 12, 13, 15, 19-27
X	US 4 447 692 A (MIERZWINSKI EUGENE P) 8 May 1984 (1984-05-08) the whole document	1-6, 12, 13, 15-17, 19-27
-/-		



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

* & * document member of the same patent family

Date of the actual completion of the international search

18 January 2002

Date of mailing of the international search report

29/01/2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Overdijk, J

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 01/01483

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 551 717 A (DREHER CARL T) 5 November 1985 (1985-11-05) figure 2 -----	1, 14-18
X	WO 99 18590 A (ERICSSON GE MOBILE INC) 15 April 1999 (1999-04-15) abstract -----	1, 7-11
P, X	WO 00 55879 A (ADD VISION INC) 21 September 2000 (2000-09-21) the whole document -----	1-27

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 01/01483

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 08137487	A	31-05-1996	NONE	
US 4022993	A	10-05-1977	NONE	
US 4447692	A	08-05-1984	CA 1208342 A1	22-07-1986
US 4551717	A	05-11-1985	NONE	
WO 9918590	A	15-04-1999	US 6035180 A	07-03-2000
			AU 9786898 A	27-04-1999
			BR 9812865 A	08-08-2000
			CN 1281581 T	24-01-2001
			EE 200000215 A	15-06-2001
			EP 1019931 A1	19-07-2000
			JP 2001519585 T	23-10-2001
			WO 9918590 A1	15-04-1999
WO 0055879	A	21-09-2000	AU 4171800 A	04-10-2000
			WO 0055879 A1	21-09-2000